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Healthcare

HEALTH BENEFITS OF PREBIOTICS: A REVIEW

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ABSTRACT Prebiotics are first defined in the mid-1990s; they fall in the category of beneficial bacteria which alter the activity and composition of gastrointestinal (GI) micro biota to improve the health of the host. Over a period of time, Prebiotics have generated scientific and consumer interest. Prebiotics include foods, medicines and dietary supplements to benefit the health. In specific, the benefits of the consumption of Prebiotics include enhanced immune function, bowel functioning and improved digestion. It also improves the bioavailability and absorption of minerals and reduces the risk of obesity. The composition and function of various Prebiotics and its interaction among and between gut micro biota and the host has created a strategy for future research to identify the research gaps.

KEYWORDS :

1. INTRODUCTION

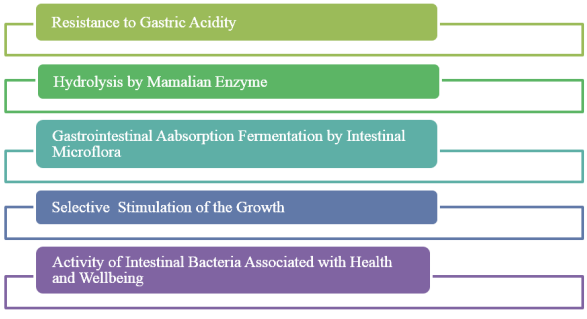
The last two decades has witnessed a boon in nutritional researches, highlighting various functional components of food that may improve health. Prebiotics have emerged as an important substance that helps in stimulating the growth of lactic acid and bifidogenic bacteria in gastrointestinal tract. (7)

According to the 'Consensus statement of International Scientific Association for Probiotics and Prebiotics [ISAPP]' "A Prebiotic is a substrate that is selectively utilized by host, microorganism offering a health benefit"(24). A holistic approach towards a healthy lifestyle includes modulation of micro biome that may improve human health. The human body has a rich microbial colony, which provides with targets for perspective to maintain health. (15)

The concept of Prebiotics has been expanded in some measures with the support of advance approaches in micro biome researches (15). To define, "the Prebiotics are defined as low digestible to non-digestible foods ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improve host health"(2).

Prebiotics are also defined as "selectively fermented ingredients that allow specific changes both in composition and /or activity in the gastrointestinal micro flora that confers benefits upon host well being and health" (23).

Prebiotics have been elaborated by certain criteria including (2)(12):



The existing ordered series of Prebiotics have been reviewed on the basis of its origin and chemical properties (7). The fermentable carbohydrates are well versed to perform these functions. These fermentable carbohydrates have a property of either not get digested or poorly digested in the small intestine and stimulate preferably, the growth of some gram positive bacteria and bifidobacteria (23).

The existing Prebiotics have been viewed by many researchers and are classified on the basis of common criteria (7).

Established Prebiotics	Emerging Prebiotics
• Fructooligosaccharides (FOS) • Galaooligsaccharidescto (GOS) • Lactulose and Polydextose	• Isomaltooligosaccharides (IMO) • Xylooligosaccharides (XOS) • Lactitol

A greater number of studies have been established by putting a focus on Inulin, FOS and GOS (23). Foods with Prebiotics have been used from ancient time. Archaeological evidence shows the intensive use of desert plants that were high in Inulin. (16). Prebiotics are naturally present in foods such as Leeks, asparagus, Jerusalem, chicory, garlic, onion, artichoke, wheat, oats, banana and tomatoes (23)(16). The production of Prebiotics can be classified in three different ways (23)

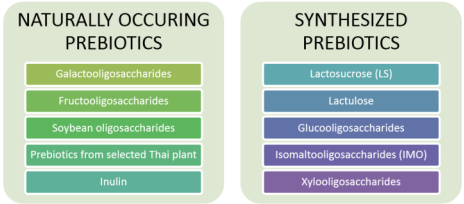
1. By extraction from plant materials
2. Microbiological synthesis or enzymatic synthesis
3. Enzymatic hydrolysis of polysaccharides

Practically, Prebiotics are often used in combination with Probiotics to provide synergic effects. These mixtures are called Synbiotics. To conclude, "Prebiotics are dietary substances that protect a selected group or colony of microorganism present in the gut. Prebiotics promotes the growth of beneficial bacteria over that of injurious bacteria". (23).

2. HISTORY

A class of compounds, called Prebiotics was renowned over twenty years ago. These compounds gained attention due to their ability to manipulate host's micro biota to improve in health (15).The term "Prebiotics" was coined in 1955 by 'Gibson and Roberfroid'. Although these were invented in early 1950s, when a bifidogenic substance "bifidus factor" which stimulates the growth of bifido bacteria was documented by 'Gyorgy and Coworkers"(23). The early Prebiotics were assessed in humans and used commercially to stimulate Lactobacillus and Bifidobacterium specifically (15). Also many other food components like Oligosaccharides and Polysaccharides (including dietary fibre) have proven to have prebiotic activity (2). The main chemical property of a Prebiotic is to reach to the colon without getting digested. Therefore the foods which are not being digested and reached to colon, for example, non-digested carbohydrates, some peptides, proteins and certain lipids are sources of Prebiotics and act as a substrate for the beneficial microorganisms (13).

3. TYPES OF PREBIOTICS



Types of Prebiotics (1)

Prebiotics helps in promoting both beneficial bacteria which are already present in the colon as well as other external Probiotics bacteria (25). Most of the Prebiotics are non-digestible and are being used in consumables like biscuits, Chocolate spread and dairy products (9) (18) (23). Natural Prebiotics like Inulin is a storage carbohydrate and is found in leeks, onions, garlic and Jerusalem. It helps in lowering triacylglycerol level and improves lipid metabolism (25).

Another naturally occurring Prebiotic Fructo-oligosaccharide is a non-digestible bifidogenic oligosaccharide (8) (26). It is a mixture of oligosaccharides consisting of Glucose linked to fructose unit (25). It can be used as substitute to sugar as they have a low sweetness and provides around 0-3 Kcal/gram are sage for Diabetics (27). These prebiotics are also helpful in accelerating the growth of beneficial bacteria, hence, preventing the colonization of pathogenic microorganisms (27). They are effective in reducing cholesterol levels and blood glucose levels, and may help in absorption of calcium and magnesium and are beneficial in lowering blood pressure (28).

One more established naturally occurring Prebiotic Galacto-oligosaccharide (GOS) produced by glycoside hydrolases (GH) by using lactose as substrate (5) (29). It is helpful in the growth of beneficial bifid bacteria (25). GOS resembles the oligosaccharides which are occurring naturally in human milk and it may also relieve the symptoms of constipation and modulate bowel functions (9) (30).

Lactulose one of the well-known synthesis Prebiotic is a disaccharide made up of Fructose and Galactose (6) (10). Lactulose is being used as laxative and is helpful in controlling constipation (10) (12). It has been reported to support the growth of bifido bacterium and reduces the count of bacteroides in human colon (130. It has been found that Lactulose can decreases the levels of ß- Glucuronidase and increase the levels of lactic acid, and is beneficial for healthy gut and vagina (15). The studies have found that Lactulose is also beneficial in reducing the urinary ammonia level (17).

The Glucose monomers Iso-maltooligosaccharides are linked by α (1, 6) – glycosidic linkages made by the enzymatic treatment of corn-starch with pullulanas, α- glucosidase and α-amylase (17). It is an emerging Prebiotic in the field of health and has been shown beneficial effects in stool frequency and wet stool during constipation (23).

4. MECHANISM OF ACTION

Prebiotics stimulates the absorption of various minerals and growth of beneficial microorganism (20) (22). Prebiotics influence the host defense by promoting the growth of beneficial micro biota by undergoing fermentation in large intestine (19) (20). Prebiotics helps in improving mucosal morphology (19). The mechanism of Prebiotics includes (23):

METABOLIC EFFECTS	• Production of short chain fatty acids, fat metabolism, absorption of ions (CA,FE,MG)
IMMUNITY EFFECTS	• Enhancing host's immunity • Cytokine Modulation etc.

5. HEALTH BENEFITS OF PREBIOTICS

I. Improves Normal Colon Transit Time

Constipation has become a common problem among large section of population. The disrupted daily life style has led to alteration in diet and eating pattern resulting in disturbed colon transit time. Prebiotics helps in increasing fecal bulk and modify stool consistency mainly by increasing fecal microbial mass. It stimulates the passage in the colon resulting in shortening transit time (23). Lactulose, one of the earliest and most established synthetic prebiotics, increases the numbers of colonic bacteria and stool water content, accelerating colonic transit time in healthy humans. It also helps in increasing stool frequency in constipation (10)(21). However, Inulin and Oligofructose have also shown probable effects as laxatives (11).

ii. Enhancement of Mineral Absorption

Intake of prebiotics mainly, fructans has proved to enhance calcium absorption (3). Other prebiotics like Isomalto-oligosaccharides, Galacto-oligosaccharides and Lactitol are proved to enhance mineral absorption (23). Consumption for prebiotics like fructans and lactulose has been prescribed as 8-10 grams/day. This may increase calcium absorption in Adolescent Girls and Boys as well as in post menopausal women. There are researches which suggest Inulin type fructans may improve bone mineralization and density in young adult. However, the work is still in its preliminary stage. (4) (11) (23)

iii. Modulation of Lipid Metabolism

Prebiotics like Inulin type Fructans has been studied for their effect on triglycerdemia in both human and animals. The studies have shown positive reduction in triglyceridemia and fasting triglycerol in animal and human respectively (4). Oligofructose has also shown positive effects to reduce hypertriglyceridemia (23). The effect of prebiotics to reduce total Cholesterol, needed more attention as there are insufficient evidence to prove its effect (14).

iv. Improved Immune Function

Gut micro biota is an important component of body as it is inextricably linked with innate immune function and metabolism (14) (23). Prebiotics Inulin has proved to stimulate the immune response and addition of Inulin with GOS mixture to feed infants has shown beneficial effects on immune system of preterm baby (10). To conclude, Prebiotics brings morphological and functional enhancement to the gut which improves colonization resistance (23).

v. Influence on Glucose and Insulin Level

Evidences suggest that Prebiotics may alter serum glucose and insulin levels in many ways. The possible effect of Insulin type fructans in modifying lipid metabolism also effect and modulates insulin and glucose concentration because of modulation of lipid metabolism is often linked to such physiological changes (4). A study done with obese women suggested that intake of FOS for 17 week reduces fasting serum insulin but there were no changes in fasting serum glucose. However, some studies shows that the effect of dietary prebiotics on insulin are contradictory. Whereas, it was seen that consumption of dietary prebiotics was associated with subjective improvement and reduction in PP glucose and insulin concentration (3)(14).

vi. Obesity and Prebiotics

Prebiotics are known to promote satiety and weight loss and prevent Obesity. The studies have defined elevated concentration of firmicutes bacteria and reduced concentration of Bacteroidetes phylum as one of the reason for obesity (3). Evidences show the consumption of fermentable fibres as short chain FOS induced satiety and thus prevent obesity (7). There are animal studies which shows that dietary supplementation of short chain fatty acid butyrate prevents diet induce obesity (14). However, consumption of prebiotics for short period did not show any significant differences in weight loss and the other study shown a significant weight reduction when prebiotics were taken for a longer duration. To conclude more dense work is need to be done to examine the effects of Probiotics to prevent Obesity

6. CONCLUSION

The emerging area of prebiotics, natural or synthetic enhances the growth and activity of Probiotics and gut micro flora and plays the holistic role towards improving the health of the host. There are polysaccharides and have potential application of surviving acidic and enzymatic digestion. They are helpful in improving bowel movement, increase immunity, Improve mineral absorption and reduce the incidence of obesity. Such a hopeful observations opens a new dimension for research of Prebiotics. Prebiotics may be incorporated as nutritional supplement in the diet. The commercial use of Prebiotics has been increased as no risk is associated with its consumption and is beneficial foe consumer health.

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